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A NEW SPECIES OF *TRIPLINERVIAE* GOLDENROD IN EASTERN CANADA (ASTERACEAE: ASTEREAE): *SOLIDAGO BRENDIAE*

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ABSTRACT

A new species of *Solidago* is described from collections made in Maritime Canada. Fernald (1915, 1950) treated some of these plants as *S. lepida* var. *elongata*, which is native to far western North America. Comparison of these entire to sharply and coarsely serrate narrower leaved specimens that are sparsely hairy to glabrate with *S. canadensis* and the broader leaved and sometimes more hairy specimens of the *S. lepida* complex from Quebec, Newfoundland, New Brunswick, Nova Scotia, and Prince Edward Island indicate that Fernald was correct in recognizing two closely related races native to the Canadian Maritimes that are similar to the mostly western *S. lepida,* but they are treated here as varieties of *S. fallax*. Fernald was incorrect in thinking that the narrower leaved race belonged in *S. elongata*. These three eastern taxa are diploid while the *S. lepida* infrequently occurring in the Maritimes is hexaploid. All four taxa are usually more stipitate-glandular and have more leafy inflorescences with ascending branches than in sometimes similar *S. canadensis*. The following new name and combinations are proposed: **Solidago brendiae** Semple, **sp. nov.**, **Solidago fallax** (Fernald) Semple, **comb. et stat. nov.**, and **Solidago fallax** var. **molina** (Fernald) Semple, **comb. nov.**

KEY WORDS: *Solidago brendiae*, *Solidago canadensis*, *Solidago elongata*, *Solidago fallax*, *Solidago lepida*, biogeography, Canada

Fernald (1915) described two new varieties of *Solidago lepida* DC., var. *fallax* Fern. and var. *molina* Fern. from Newfoundland and Gaspésie, Québec, respectively. He treated a distinctive third race as belonging in *S. lepida* var. *elongata* (Nutt.) Fern. All three races are similar to *S. canadensis*, within which some authors have included them, e.g., Beaudry (1968), Cronquist (1968). Marie-Victorin (1995) confined *S. lepida* to the typical variety and included the more eastern varieties in *S. canadensis*. Semple and Cook (2006) treated Fernald's two eastern varieties of *S. lepida* as synonyms within the single taxon *S. lepida* subsp. *fallax* (Fern.) Semple and restricted *S. elongata* Nutt. to the far western USA from central California to northern Washington. Recently seen collections indicate that *S. elongata* also occurs in southwestern British Columbia (Semple et al. 2013). Field observations, unpublished cytogeographic studies, and a multivariate morphometric analysis of herbarium collections (Semple et al. 2013) indicate that Fernald's var. *elongata* from eastern North America represents a previously undescribed species.

Solidago brendiae Semple, **sp. nov.** **TYPE: CANADA. Quebec**. Gaspésie Co.: Parc Nat. du Gaspésie, Hwy-163 near end, slope of Mont Ernest-Laforce, open area near road, 643 m elev., 48° 55' 45.4" N, 66° 03' 46.2" W; leaves dark green, shiny; all shoots collected from one plant; sparsely glandular in capitulescence; 30 Aug 2006, *J.C. Semple & Brenda Semple 11437* (holotype: WAT; isotypes; MO, MT, UNB). The isotypes were distributed as "*Sol. lep.* var. *gaspensis*, ined."). Figs. 1 and 2.

Solidago brendiae is similar to *S. fallax* but differs from it in having narrower upper leaves with fewer serrations; it differs from *S. canadensis* in having longer upper stem leaves, heads with taller involucres, and more ray florets.

Figure 1. Holotype of *Solidago brendiae* (WAT

Figure 2. Details of holotype of *Solidago brendiae* (WAT). **A.** Mid stem. **B.** Upper stem leaves. **C.** Upper mid stem leaf, proximal abaxial surface; insert is enlargement of lateral vein. **D.** Mid stem leaf showing with small marginal serrations. **E.** Inflorescence with mostly post anthesis heads. **F.** Heads on lower inflorescence branch. **G.** Disc floret cypselae. Scale bars: = 1 mm in A, C, D, F and G; = 1 cm in B and E.

Plants 60–**100**–162 cm; rhizomes short to long creeping, forming few- to many-stemmed clones. Stems 1–20+, erect, proximally glabrous or rarely sparsely to moderately canescent-villous,

distally sparsely to densely so. **Leaves**: basal 0; mid stem leaves sessile, blades narrowly oblanceolate, 58–**94**–154 × (5–)8–**10**–13(–18) mm, tapering to bases, margins entire to coarsely sharply serrate, 0–**6**–10(–15) serrations per side, 3-nerved, apices acute to acuminate, abaxial faces sometimes shiny glabrous to sparsely short strigose, adaxial glabrous to sparsely strigose on veins; upper stem leaves sessile, blades narrowly lanceolate to narrowly elliptic, 32–**70**–129 × 4–**9**–12.5(–20) mm, somewhat reduced distally in arrays, margins sharply and coarsely to finely serrate or entire, usually becoming less serrate near arrays, faces glabrous or sparsely strigoso-villous, more so along abaxial nerves, distalmost (below arrays) sometimes sparsely minutely stipitate-glandular. **Heads** 25–500+, in sometimes secund, broadly thyrsiform or secund pyramidal arrays, 7–**18.5**–38 cm tall × 3–**11**–20 cm wide, usually leafy proximally, branches usually ascending-diverging to sometimes arching-spreading, leaves sometimes minutely stipitate-glandular. **Peduncles** 1–3 mm, villoso-hirtellous, sometimes minutely stipitate-glandular; bracteoles 0–2, linear-lanceolate, sometimes minutely stipitate-glandular. **Involucres** turbinate, (2–)2.6–**3.2**–3.8(–6) mm. **Phyllaries** in 3–4 series, deltate-lanceolate to linearly oblong, unequal (outer 1/4 – 1/3 length of inner), margins sparsely ciliate, apices acute to obtuse, glabrous or sparsely to moderately, minutely stipitate-glandular apically or on margins. **Ray florets** (7–)10–**13**–16(–21); laminae (0.5–)0.7–**1.2**–1.7(–3.5) × ca. 0.2–**0.35**–0.7(–2.4) mm; ovary (0.3–)0.5–**0.85**–1.5 mm, sparsely strigillose, pappi 1.2-**1.9**-2.6 mm at anthesis. **Disc florets** 2–**5.8**–8(–13); corollas ca. 2–**2.95**–3.5(–4.3) mm, lobes (0.2–)0.5–**0.75**–1.2 mm. **Disc cypselae** (narrowly obconic) 0.4–**0.85**–1.5 mm at anthesis, sparsely strigillose; pappi (1.4–)1.7–**2.1**–2.9 mm. **Chromosome number**, $2n$ = 18. [Measurements: means are in **boldface**, extremes of ranges in parentheses]

Calcareous sand and gravel soils, sandy clay loam soils, stream margins and banks, road sides and wet ditches, recently cleared land, disturbed ground, gravelly shores. Newfoundland, southern Labrador, New Brunswick, northern Nova Scotia, Prince Edward Island, and Québec (Figs. 3 and 4); very rare or possibly just adventive in northern Ontario; rare or adventive in Maine.

The species is named in honor of my wife Brenda Semple, who has accompanied me on field trips for more than three decades. She was a co-collector of the type collection made on a field trip to the Gaspé and the Maritimes during which it rained for eleven straight days! Brenda's Goldenrod is one result of that field work.

Solidago brendiae is similar to *S. canadensis* and *S. fallax*. A multivariate morphometric analysis of the complex including *S. brendiae, S. canadensis, S. elongata, S. fallax, S. gigantea, S. lepida,* and *S. rupestris* was undertaken to clarify morphological limits of the taxa involved. The details of the multivariate study will be presented in several publications on eastern taxa plus *S. elongata* (Semple et al. 2013 submitted) and on the western taxa. The full study included 28 vegetative and floral traits scored on 267 specimens of *Solidago* subsect. *Triplinerviae* (Torr. & A. Gray) Nesom. In the multivariate study of subsect. *Triplinerviae* focusing on northeastern North America taxa plus *S. elongata* (and excluding *S. gigantea* and *S. rupestris*) *S. brendiae* separated well from other taxa (Semple et al. 2013) with 24 of the 27 specimens (89%) being placed into *S. brendiae* a posteriori with high probabilities for the majority of specimens. Specimens of *S. brendiae* from Newfoundland, northern Nova Scotia, northern Ontario, Prince Edward Island, and Québec were included in the analysis. The details of the study are presented in Semple et al. (2013).

The distribution of *Solidago brendiae* is based on collections seen at or borrowed from GH, MIN, MT, NEBC, and WAT (Thiers, continuously updated). It is common in the Gaspé Peninsula and along the north shore of the St. Lawrence in Québec and at scattered locations in western Newfoundland. It occurs at scattered locations in northern Prince Edward Island and on Cape Breton, Nova Scotia (NS. Cape Breton Co., N of Enon, *Semple & Keir 4773,* WAT). I have seen one collection from southern Labrador (Traverspine R., 53° 15' N, 60° 17' W, *Gillet & Finley 5617,* GH)

and from Quebec to the south (PQ. Cote-Nord, MRC Minganie, Mun. de Lac Jerome, 50° 46' N, 61° 39' W, *Blondeau NAT02-062,* WAT). The range extends west across Québec from Lac Saint-Jean to Lac Mistassini and in scattered locations to near Ontario. I have seen a collection from Red Lake in northwestern Ontario (ON. Kenora Dist., 51° 01' N, 93° 51' W, *Brunton & Crins 6140,* WAT), which is possibly introduced or very disjunct from the northwestern Québec area. It occurs in New Brunswick, but I have seen only two collections documenting this to date (W of Bouctouche, Semple & Semple 11468 WAT; SW of Fredericton, *Semple 11518,* WAT).

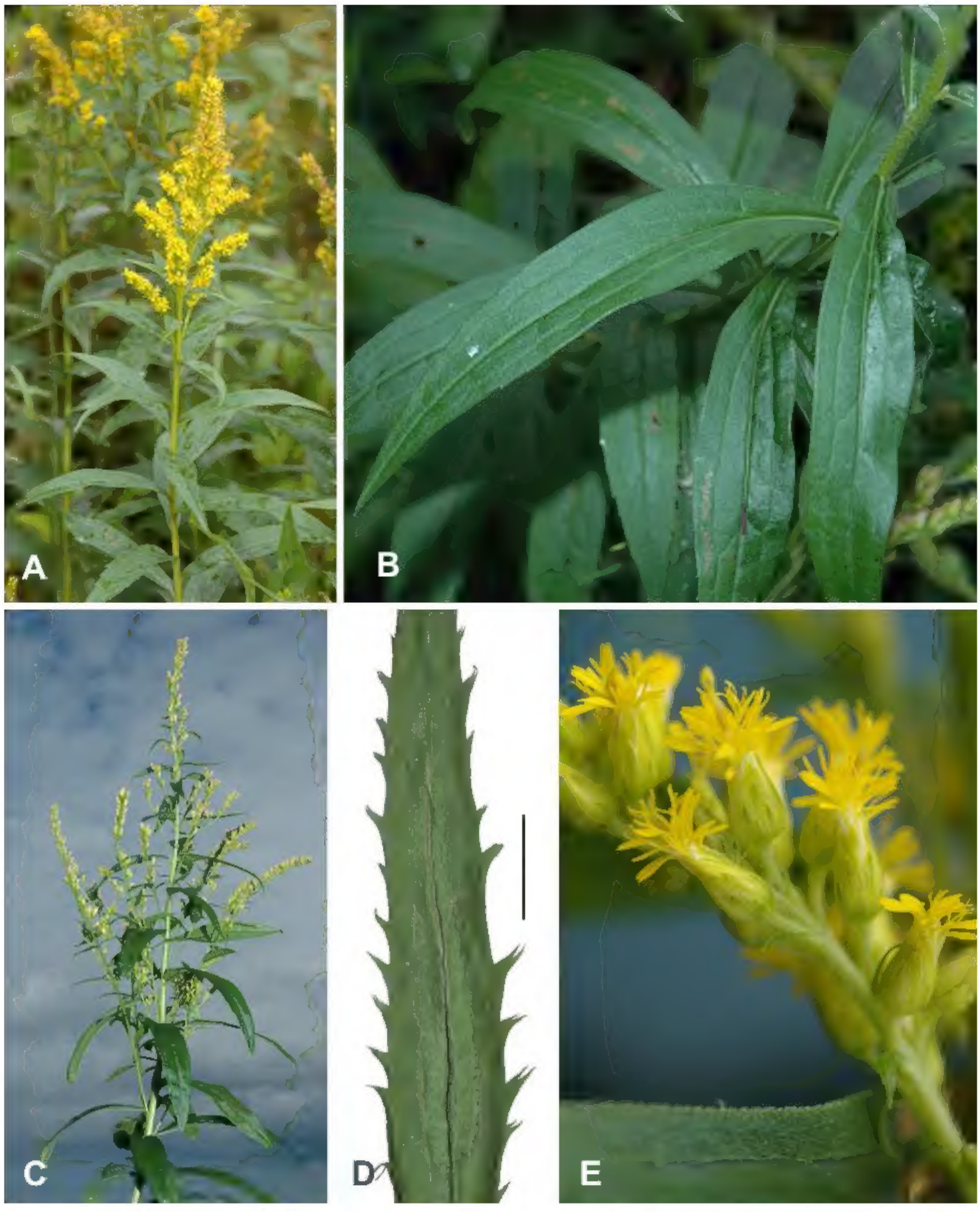

Figure 3. *Solidago brendiae* in the field. **A.** Holotype population, *Semple & Semple 11537*. **B-C.** *Semple 11434*, Gaspé Peninsula, Québec. **B.** Shiny mid stem leaves. **C.** Leafy Inflorescence with a few elongated and ascending branches. **D.** Lower mid stem leaf with very large serrations, *Semple 11471*, Prince Edward Island. **E.** Flowering heads, *Semple 11434*.

Figure 4. *Solidago brendiae* habitats. **A.** Holotype population, *Semple & Semple 11437*, Mt. Ernest-Laforce, Gaspé Peninsula, Québec. **B-C.** *Semple 11431-11434*, base of bluff along St. Lawrence R., Gaspé Peninsula, Québec.

Of note, the distribution of *Solidago brendiae* around the Gulf of St. Lawrence is similar to the distribution of supposed nunatak areas shown in the St. Laurence basin map in Marie-Victorin (1938). Marie-Victorin noted the disagreement regarding such non-glaciated higher elevation areas and that the possible remnants of the hypothesized interglacial flora sometimes occurred at lower elevations. Peirson (2010) and Peirson et al. (2013 on line) noted that molecular data indicate that the northeastern members of *Solidago* subsect. *Humiles* (*S. chlorolepis* Fern., *S. racemosa* Greene, and *S. randii* (Porter) Britt. are pertinent here) may have evolved in the last interglacial period or earlier. *Solidago chlorolepis* is native to just Mt. Albert in the Gaspé and is likely a remnant of an interglacial flora. I think that the same is probably true for *S. brendiae* and *S. fallax* and possibly *S. canadensis*, which all evolved from of an interglacial expansion of diploid proto-*S. lepida* from the west into the east. Hexaploid *S. lepida* in the east today is likely the result of post glacial Holocene migration eastward from western Canada. Collections of *S. brendiae* can be difficult to distinguish from *S. canadensis* and *S. fallax*.

When I first encountered *Solidago brendiae* on the northern Gaspé in 2006, I immediately decided that it was a distinct race included in *S. lepida*. The late Dr. John K. Morton made numerous collections of the complex in Quebec and Newfoundland during several field trips. These were in folders that he labeled "*S. canadensis* aff. var. *fallax*." Like Fernald before him, Morton recognized that these northern "*S. canadensis*" collections were something different from typical var. *canadensis* but were also not *S. fallax*. Both botanists also collected *S. brendiae* in Newfoundland but did not recognize it as a new taxon in the *S. canadensis*-*S. lepida* complex.

It took a lot of work since the 2006 field trip, access to all of John Morton's extensive personal research collections, and the assistance of a dozen undergraduates working in my lab to accumulate the data needed to confirm the distinctiveness of *Solidago brendiae*. Every collection labeled "S. canadensis" from Newfoundland and northern Québec that I have seen to date has turned out to be an individual of *S. brendiae*. Many more collections from eastern Canada still need to be examined to confirm that *S. brendiae* completely replaces *S. canadensis* at about 47° N latitude northward.

A syntype of *Solidago canadensis* var. *glabrata* Porter (Bull. Torrey Bot. Club 21: 310. 1894) also belongs in *S. brendiae*: Maine. Mt. Desert Island, Road from Hadlock farm to Frenchman Camp, 6 Sep 1892, *Redfield s.n.* (GH!). Other syntypes of *S. canadensis* var. *glabrata* that I have seen do not belong in *S. brendiae*: Maine. Mt. Desert Island, 30 Aug 1893, *Redfield s.n.* (NY, digital image!, = *S.* aff. *canadensis*), meadow above Long Pond, 5 Sep 1894, *Redfield s.n.* (NY, digital image! = *S. canadensis*); Pennsylvania. Luzerne Co., Lily Lake, 16 Aug 1889, *Heller s.n.* (PH, on line image!, designated here as the lectotype = *S. gigantea* Ait.). How far into the USA the range of *S. brendiae* extends is yet to be determined, but Maine is likely the only state in which it occurs.

Six individuals of *Solidago brendiae* were determined to be diploid ($2n = 18$) at four locations in the Gaspé region of Québec, Canada. Vouchers are deposited in WAT at MT.

Solidago brendiae Semple — $2n = 18$. **CANADA. Quebec**: Gaspésie, N of Grande-Cascapédia, Hwy-299, fishing access site #27, by Rivière Cascapédia, *J. Semple & B. Semple 11443*; E of Marsoui, Hwy-132, base of steep hill, *J. Semple 11432*, *J. Semple 11433*, *J. Semple 11434*; S of Marsoui, 2.6 km S of Hwy-132 on rd SE of lumber mill, *J. Semple 11436*; Les Méchins, junction of Hwy-132 and Rte. du Moulin, bank of small river, *J. Semple & B. Semple 11430*.

The following two new combinations are proposed based on work done for this manuscript.

Solidago fallax (Fernald) Semple, **comb. et stat. nov.** *Solidago lepida DC. var. fallax* Fernald, Rhodora 17(193): 9. 1915. Fl. S. Brit. Columbia 301. 1915. *Solidago lepida* DC subsp. *fallax* (Fernald) Semple, Sida 20: 1611. 2003. **TYPE: CANADA. Newfoundland**. Harry's River, gravelly thicket, 18 Aug 1910, *Fernald & Wiegand 4108* (holotype: GH!; isotypes: CAN!, NY!)

Solidago fallax (Fernald) Semple var. ***molina*** (Fernald) Semple, **comb. nov.** *Solidago lepida* DC. var. *molina* Fern., Rhodora 17: 9. 1915. **TYPE: CANADA. Quebec**. Percé, Cap Barré, 16 Aug 1904, *Collins, Fernald, & Pease s.n.* (holotype: GH!).

Leaves of *Solidago fallax* are broader than those of *S. brendiae* and *S. canadensis* and usually have large broad-based serrations along the margins, although *S. brendiae* can sometimes have large serrations (Fig 3D). Typical var. *fallax* has smooth lower stems and sparsely strigose-villose upper stems. Stems of var. *molina* are much more pubescence from near the base of the stem upward; this can make the plants look similar to *S. altissima*, which lacks the large upper leaf serrations. *Solidago fallax* occurs in eastern Quebec, Labrador, and Newfoundland. Plants of *S. fallax* var. *molina* occur as far west as northern Ontario along James Bay and Hudson Bay, in western Quebec adjacent to Ontario, on the Gaspe Peninsula, and in western Newfoundland. The southern Hudson Bay collections from Ontario are diploid (Semple et al. 1993, *Clements s.n.*, WAT as *S. lepida*), while convergent, more hairy forms of *S. lepida* var. *lepida* are hexaploid (Melville and Morton 1982, as *S. lepida* and some as *S. altissima*; Semple et al. 1984, as *S. lepida*). Further study is needed on the complex in northern Ontario and adjacent Québec.

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